

Competition from the Relation between Price-Cost Margins and Market Shares”).

213. This paradox, however, is explained not by a breakdown in standard economic theory, but by two critical mistakes Professor MacAvoy makes in his analysis: (1) relying on price measures that fail to capture most of the declines in long-distance prices that have occurred since 1984; and (2) relying on a defective measure of marginal cost. I have already discussed the errors in Professor MacAvoy’s analysis of prices.

#### 1. Marginal Cost

214. Professor MacAvoy relies, in part, on data presented by the WEFA Group in *Economic Impact of Eliminating the Line-of-Business Restrictions on the Bell Companies*<sup>66</sup>, for his data on the marginal cost of long-distance service. In my opinion, WEFA’s attempt to measure marginal cost bears little relation to the concept of marginal cost relevant for the comparison to price and the measurement of profit margins. WEFA estimates that the incremental cost of an additional message minute is no more than \$.01 per minute. Adding this to a measure of access cost, WEFA computes a total marginal cost of \$.065. This calculation is equivalent to measuring the marginal cost of a shoe from the wholesale cost of its leather. WEFA omits almost all the elements of cost that account for employment in the long-distance industry. According to WEFA, then, a long-distance carrier never has to bill a customer and never has to handle a customer service call.

215. Professor MacAvoy follows WEFA in considering only network and access costs in his measure of marginal cost.<sup>67</sup> The result is a completely unrealistic concept of marginal cost. On the other hand, Dr. Crandall and Professor Waverman take a much more realistic approach to measuring marginal cost, including the many components of cost that Professor MacAvoy ignores. They calculate that Ameritech’s marginal cost would be in the range from 11.4 cents to 12.4 cents per minute, if Ameritech incurred

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<sup>66</sup> WEFA Group, *Economic Impact of Eliminating the Line-of-Business Restrictions on the Bell Companies*, July 1993, pp. 20-21.

<sup>67</sup> *MacAvoy Affidavit*, p. 33.

the same costs as AT&T for marketing, customer service, and overhead.<sup>68</sup> They believe that some of AT&T's costs may be higher than Ameritech's would be, but still their estimates indicate that a figure for marginal cost of around 10 cents per minute may be reasonable.

216. Professor MacAvoy fails to consider cost differences across products. In particular, billing costs vary considerably from one product to another primarily because the costs to bill an individual customer are so high. Failure to consider differences in costs distorts Professor MacAvoy's price-cost margin analysis. According to MCI, the cost to bill an additional customer for the first call is 46 cents. The additional billing cost per call is about 1.5 cents.

217. Professor MacAvoy also fails to match the costs with the product he is discussing although he computes separate price-cost margins for switched and WATS services. These products have different patterns in using the network. His calculation of costs for residential users should include network costs that reflect the usage patterns for residential customers as well as billing costs for residential customers. Similarly, WATS services should reflect the costs incurred by WATS calls.

218. The only difference he recognizes is the difference in access costs. However, this calculation appears improper. He has relied on tariffed data from Pacific Bell but he has disclosed nothing about his use of his data. However, the magnitude of the access charge for dedicated access, which is billed per line and per minute, appears to be computed as the price for the line divided by, perhaps, the maximum number of minutes the line can carry.<sup>69</sup> The average price should be calculated as the price divided by the average number of minutes. However, since Professor MacAvoy is using marginal costs, so should he use a marginal cost here. Because the number of access lines purchased is determined by using switched access for calls at peak periods, the marginal cost should be a number close to the price of switched access. Professor MacAvoy's number is too low to be credible.

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<sup>68</sup> *Crandall-Waverman Affidavit*, p. 45.

<sup>69</sup> *MacAvoy Affidavit*, p. 31.

## 2. Price-Cost Margins

219. To summarize, Professor MacAvoy only measures the spread between higher standard rates and the cost of access and transmission. He ignores the large gap between standard rates and actual revenue and ignores another large gap between total marginal cost and access and transmission cost.

220. Professor MacAvoy also studies the trend in the price-cost margin for long distance.<sup>70</sup> He finds that the margin has risen and is understandably puzzled by his paradoxical finding that the price-cost margin was rising during times when concentration was falling. But the evidence suggests that the price-cost margin, properly measured, has *declined* in long distance in the past decade. This decline is consistent with increasing competition, and it resolves Professor MacAvoy's puzzle. As predicted by economic principles, the price-cost margin fell during the same period that concentration was falling.

### D. Evidence about the Extent of Competition from the Relation between Price-Cost Margins and Market Shares

221. Professor MacAvoy uses the framework of conjectural variations to examine the relation between the market shares of AT&T, MCI and Sprint and their price-cost margins.<sup>71</sup> This framework, though well known, is not considered by specialists in industrial organization to be a completely satisfactory way to capture the strategic interaction of oligopolists.<sup>72</sup> Although the approach has some practical value, the theory of conjectural variations cannot be rationalized in terms of formal game theory, which provides the basis for most modern analysis of oligopoly. In any case, Professor MacAvoy's findings in the framework are nothing short of absurd. They only demonstrate the defects in the data and say nothing about the interactions among sellers in the long-distance market.

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<sup>70</sup> *MacAvoy Affidavit*, p. 43-44.

<sup>71</sup> *MacAvoy Affidavit*, p. 18.

<sup>72</sup> Professors Sibly and Weisman go further, referring to the "now-discredited conjectural variations model" in their affidavit on behalf of SBC Communications, paragraph 29.

222. The basic idea of the analysis is that the relation between a firm's market share and its price-cost margin reveals information about how the firm interacts with the other sellers in the industry. In a purely competitive market, all margins are zero. Each firm believes that any decrease in its own quantity sold will result in a fully offsetting increase in sales by other firms, and price will not change. In a market where firms cooperate and share monopoly profits, each firm believes that other firms will cut their sales if this firm cuts its sales. Then the price-cost margin is positively related its market shares. In the standard intermediate case—the Cournot model—one firm believes that other firms do not change their sales if this firm cuts its sales. Then price-cost margins are somewhat positively related to market shares.

223. Professor MacAvoy finds that MCI and Sprint fall into the category of firms that believe they control other firms' output.<sup>73</sup> Their measured price-cost margins are high in relation to their market shares. His model can explain this relation only by attributing a belief that high prices in relation to cost are optimal because the firms control AT&T's output. On the other hand, AT&T has a similar profit margin but a much higher market share. The model explains this relation by attributing a belief to AT&T that the rest of the sellers will raise their output if AT&T decreases its output, a belief that the market is fairly competitive.

224. It would be difficult for the most talented writer of fiction to dream up a more fanciful explanation of market share differences among the sellers of long distance. AT&T, according to Professor MacAvoy, has a high market share solely because it sets a high level of output based on the belief that its rivals are quite competitive. Sprint, on the other hand, has a much smaller market share purely because its managers believe that every time it expands its output, its rivals expand by 2.31 times as much.<sup>74</sup> Surely a reasonable analysis of market shares would consider AT&T's head start from its legal monopoly position 13 years ago and the strength of its brand name. An analysis of market shares that does not consider these factors should receive no consideration at all.

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<sup>73</sup> *MacAvoy Affidavit*, p. 17-18, 66.

<sup>74</sup> *MacAvoy Affidavit*, p. 66.

225. Professor MacAvoy's findings are also an artifact of his gross overstatement of profit margins, resulting from his overstatement of price levels and understatement of marginal cost, as I have discussed earlier. A proper measure of profit margins would result in quite negative conjectural variations for all three of the firms he considers. The embarrassingly large differences in the conjectural variation that he finds are the direct result of his overstatement of profit margins.

226. Professor MacAvoy would have abandoned his attempt to infer conjectural variations from market shares if he had thought to consider Excel, a carrier with a market share of 0.5 percent (prior to its proposed merger with Telco). If I assume its price-cost margin is similar to AT&T's., then repetition of MacAvoy's method reveals that Excel believes that for each additional call it supplies, its rivals reduce their supply by 98 calls! Despite the fact that Excel has no fundamental disadvantage in the market, according to MacAvoy's model, the carrier is completely hobbled and unable to expand because of its belief about how its rivals will expand if it does. If it could shed this belief and adopt AT&T's more optimistic belief, its market share would rise to the same level as AT&T's.

227. Professor MacAvoy's ridiculous findings are nothing more than the result of the price and cost measurement problems I have detailed earlier. The available evidence suggests that the price-cost margin is low and falling. In that case, a statistical analysis using a proper measure of the price-cost margin would show that MCI and Sprint see the market as highly competitive. They do not indulge themselves in the fantasy that their rivals would hold back if they overpriced their products. Rather, they are keenly aware that only by delivering reliable, high-quality service at competitive prices will they be able to stay in the market.

#### **E. Benefits from Ameritech's Entry into Long Distance**

228. Ameritech's experts argue that the company's presence in the long-distance market will increase competition in the industry and will reduce the market power of the incumbent carriers. I believe they seriously overstate the benefits from Ameritech's control of a long-distance carrier and ignore the hazards that would flow from Ameritech's vertical integration. The main defect in their analyses can be stated succinctly:

Without offering any factual justification, they posit a world in which profit opportunities can be seized by Ameritech alone and by no other firm. In their view, high long-distance prices in relation to cost have left billions of dollars on the table that Ameritech is uniquely positioned to exploit.

229. Another general defect of Ameritech's experts' position is that they fail to consider the benefits of policies, notably the proper pricing of access, that would not invite the breakdown of cooperation that abandoning structural separation would cause.

230. Ameritech's experts offer as their principal argument in favor of the company's admission to the long-distance market that it will reduce the market power of the current long-distance carriers. This argument has three major defects: (1) entry by any particular firm would not, especially in the longer run, change the number of carriers or affect market power; (2) given the absence of barriers to entry and the absence of abnormal profit, there is no substantial market power left for Ameritech to compete away, and (3) Ameritech's control of a long-distance carrier may well *increase* market power in the long-distance market because of the breakdown of its existing cooperative relations with long-distance carriers who would become rivals. The decreased efficiency of independent long-distance carriers after the breakdown of cooperation would result in higher prices and diminished consumer welfare. Ameritech's experts show little concern for the hazards of vertical integration of local carriers into long-distance service.

1. Dr. Crandall and Professor Waverman's Analysis of the Effect of Ameritech's Control of a Long-Distance Carrier

231. Dr. Crandall and Professor Waverman conclude that Ameritech's control of a long-distance carrier would be beneficial after studying a number of situations they believe are analogous.<sup>75</sup> Four of these appear to be completely off the point. Improvements that occurred when the Chilean long-distance and British cellular markets were opened to competition are comparable to the huge benefits that Americans achieved when the long-distance market opened up in 1984 and have nothing to do with the potential entry of one more seller into a market with numerous sellers. Two

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<sup>75</sup> *Crandall and Waverman Affidavit*, p. 45.

others—luxury cars and steel—are completely unrelated and have (or had) high barriers to entry, just the opposite of long distance, where there are hundreds of firms in the market. The only analogy that Dr. Crandall and Professor Waverman consider that is on point is SNET's entry to long distance. As I demonstrate in part F of this section, there has been only one substantive change in the Connecticut long-distance market since SNET's entry—Connecticut AT&T customers must now deal with two separate bills, because SNET no longer cooperates with AT&T in billing. SNET is a high-price seller of long-distance service.

232. Dr. Crandall and Professor Waverman believe that prices would fall in the Michigan long-distance market upon Ameritech's entry. They project price reductions by rival long-distance carriers as Ameritech takes 25 or 30 percent of the market away. However, existing long-distance prices are close enough to cost that significant responses are impossible. Dr. Crandall and Professor Waverman estimate long-distance costs to be 11.4 to 12.4 cents per minute.<sup>76</sup> MCI One customers in Michigan currently pay 12.0 cents per minute.

233. Another reason that Dr. Crandall and Professor Waverman offer to support their projection of price declines following Ameritech's presence is that "...the entry by large RBOCs into inter-LATA services has already reduced wholesale rates for long distance service to between 1 and 2 cents per minute."<sup>77</sup> I believe that this figure is correct for the wholesale price of bulk network capacity, but there is no evidence in their affidavit nor none available to me that the price has changed as a result of the local phone companies' large purchases in the market. For several years, as I noted in Part IV, there has been a large and fluid market for bulk capacity. Any actual or potential long-distance carrier, local phone company or otherwise, can participate in that market. The market is one of the reasons that barriers to entry in long distance are so low.

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<sup>76</sup> *Ibid.*, p. 52.

<sup>77</sup> *Crandall-Waverman Affidavit*, p.52.

234. Finally, Dr. Crandall and Professor Waverman offer the novel theory that the same market can undergo a transition to open competition twice.<sup>78</sup> They hypothesize that control of long-distance carriers by Ameritech and other RBOCs will have the same effect in a market with four aggressive large players and hundreds of smaller players that the entry of all of these players had to the market that AT&T once had as a legal monopoly. Surely this is farfetched!

2. Professor MacAvoy's Analysis of the Effect of Ameritech's Control of a Long-Distance Carrier

235. Professor MacAvoy presents a quantification of benefits he believes Michigan consumers would achieve from Ameritech's presence in long distance.<sup>79</sup> Based on a survey of consumers, he concludes that Ameritech will gain a 25 percent share of the market. He then recalculates industry equilibrium based on the model I discussed in Section III, part H. In the new equilibrium, the price falls from 15 cents to 10.1 to 10.2 cents per minute (depending on the level of cooperation among rivals). Consumers benefit directly from the price reduction and also gain additional consumer surplus from the additional long-distance services they buy at the lower price.

236. I noted earlier that Professor MacAvoy uses the price of 15 cents for this calculation, even though his price data claim that consumers are paying more like 25 cents. If he really believed his price data, his estimates of consumer benefits would be even more exaggerated.

237. Because Professor MacAvoy's estimates of consumer benefits are so large, I will review my earlier criticism of his approach in some detail, restated to reveal the defects in his calculation of consumer benefits. First, although 15 cents is not an unrealistic figure for existing prices, Professor MacAvoy uses an estimate of marginal cost of 7.2 cents<sup>80</sup>, a gross underestimate. Dr. Crandall and Professor Waverman suggest a figure of around 12 cents, by contrast. Recalculation of Professor MacAvoy's

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<sup>78</sup> *Ibid.*, p. 54.

<sup>79</sup> *MacAvoy Affidavit*, p. 69.

<sup>80</sup> *MacAvoy Affidavit*, p. 68.



consumer benefit figure for a price-cost margin of 3 cents would give a much smaller figure, though for reasons I will discuss shortly, I believe it would still be a serious overestimate.

238. The central defect of Professor MacAvoy's benefit calculations is the erroneous model of the determination of market shares in the model he uses. Recall that AT&T has a market share of around 50 percent in his view because its managers have an optimistic view about their rivals—they will lower their output just a bit if AT&T expands its own output. Excel, on the other hand, is desperately handicapped because its managers believe that for each extra call they sell, their rivals sell an additional 98 calls. They dare not expand at all. So Excel remains at a tiny 0.5 percent market share. Should AT&T be swept by pessimism and adopt Excel's view about its rivals, and at the same time if Excel should adopt AT&T's optimistic view, Excel would expand to take 50 percent of the market and AT&T would shrink to 0.5 percent. The model admits of no other determinant of market share.

239. Professor MacAvoy assigns a degree of optimism to Ameritech's managers that is not too different from AT&T's. He solves for the price-cost margin for Ameritech, which is not too different from AT&T's because the two ingredients in the calculation, the market share and the conjectural variation, are about the same for the two companies. But suppose that Ameritech shared MCI's more pessimistic view about its rivals' responses—then the same calculation assigns an impossibly high price-cost margin to Ameritech. Professor MacAvoy has no data or other source of any kind to support his assumption about Ameritech's conduct, so his calculations for the market after entry are completely meaningless. He could have found any result he wanted, from the highest benefit to the lowest, by making different assumptions about the key parameter.

## F. Lessons from Experience in Connecticut

240. The local telephone company serving Connecticut, Southern New England Telephone (SNET), began selling long-distance services in 1994. At the same time, the local toll market was opened to competition. Experience since then is helpful in understanding what happens when an upstream monopolist begins to compete in a downstream market. As yet, failure to

determine wholesale rates for the local network has blocked meaningful local competition—SNET has retained a near-monopoly in providing local service including access.

241. SNET has a huge competitive advantage in the Connecticut market for interstate long-distance calls because the Telecommunications Act prohibits responses by its national rivals that apply only to Connecticut. WorldCom and the other national long-distance carriers would have to lower their prices nationally in order to respond to SNET's pricing. SNET has done little to take advantage of this perverse feature of the law. SNET's interstate rates are 23 cents per minute during the day and 13 cents at night, with small discounts for high volumes. By contrast, the MCI One rate is 12 cents per minute at all times, for calls in excess of \$25 per month, and 15 cents per minute for calls less than \$25 per month. The AT&T One Rate and Sprint Sense Day Plan, completely unrestricted plans with no fixed charges and no minimum purchases, cost 15 cents per minute. Much lower rates are also available, including AT&T's One Rate Plus rate of 10 cents per minute. The Connecticut long-distance customer has gained no meaningful advantage from SNET's control of a long-distance carrier in the market.

242. SNET is also the high-price seller in the local toll market. In this respect it is no different from the other local telephone companies, such as Ameritech, who have placed themselves toward the top of the distribution of prices in local toll markets, as these markets have been opened to competition. If you subscribe to SNET's interLATA service SNET's local toll charge is 18 cents per minute during the day and 10 cents at night and on the weekend. It is an astonishing fact that I, a part-time resident of Connecticut, pay half again as much per minute to call from New Haven to Killingworth using SNET as I pay to call to California. By contrast, AT&T's local toll rate in Connecticut is 5 cents per minute for One Rate and One Rate Plus, MCI's is 10 cents per minute, and Sprint's is 10 cents per minute off-peak and 15 cents during peak hours.

243. SNET's responses to becoming a rival of the long-distance carriers are in line with the analysis presented earlier in this affidavit. Previously, SNET was a supplier to the long-distance carriers—it enjoyed its position as the monopoly seller of access services at high prices. SNET cooperated voluntarily with the long-distance carriers. For example, SNET had a contract with AT&T to bill AT&T's customers on their local phone bills.

SNET terminated this cooperation when AT&T became a rival. In addition, SNET has prevented the long-distance carriers (with the exception of SNET's long-distance supplier, Sprint) from offering presubscription for local toll. MCI's customers must remember to dial 10222 in order to take advantage of MCI's low prices for local toll calls. Although the Act prohibits regulators from compelling local toll presubscription, SNET would offer it voluntarily if were not a rival in the local toll market.

244. The main change that has occurred in Connecticut from the perspective of the typical telephone customer is that some of them have lost the convenience of receiving a single phone bill for local and AT&T long-distance service. There have been no meaningful benefits in the form of reduced prices. Nothing in the experience in Connecticut supports the extension of the policy of permitting a local telephone company to enter the long-distance market while the company still dominates the access market. If substantial local competition develops in Connecticut, most of the harm associated with SNET's withdrawal of cooperation will be ameliorated.

## VII. Conclusions

245. I can find no benefit from Ameritech's control of a long-distance carrier other than to Ameritech itself. The company will be able to obtain a substantial market shares in Michigan's long-distance market because of its ability to hobble its long-distance rivals. In addition, it will have the advantage of facing the true cost of access, which is less than the access charge paid by its rivals, though, as I explained earlier, this advantage is tempered by the opportunity cost when Ameritech takes a call away from rival who depends on Ameritech for access. The result will be a reduction in competition in long distance and higher prices to the long-distance consumer. Further, Ameritech's presence in long distance would lower incentives for entry of independent local carriers and inhibit the development of local competition. Local telephone prices would be higher as a result.

246. The Telecommunications Act relies on the principle of structural separation until there is sufficient local competition that the principle is no longer needed. This principle imposes a limitation on telephone carriers—that there may be no joint operation of local and long-distance service. I believe that the principle of structural separation is a sound one under current and near-future conditions, from the point of view of the welfare of the U.S. consumer. Structural separation does *not* reduce the number of sellers in the long-distance market. Nor does structural separation decrease consumer welfare.

247. I believe that consumers benefit from continued structural separation of local service and long distance. Contrary to Ameritech's submissions, structural separation remains a valid principle for governing the telephone industry as long as there is not active competition in local telephone service for all groups of customers.

248. Many discussions of the economic effects of permitting local telephone companies to control long-distance carriers presume that another long-distance seller will improve competition and lower the price of long-distance services. The primary reason to be skeptical of this presumption is the evidence presented in Part IV showing the advanced degree of competition in the long-distance market. What could a local telephone company do that companies such as WorldCom—already in nationwide operation—have not already done?

## VIII. About the Author

249. I serve as Professor of Economics at Stanford University and also Senior Fellow at Stanford's Hoover Institution. I received a Ph.D. in economics from the Massachusetts Institute of Technology in 1967. I have been elected a fellow of the American Academy of Arts and Sciences and a fellow of the Econometric Society. I have published 7 books and numerous articles in several areas of applied economics. I have extensive experience in the economics of telecommunications, computers, and software. Recently I served as an expert for the Department of Justice in its case against

Microsoft and in its opposition to Microsoft's proposed merger with Intuit. Further information about my professional activities is in my *curriculum vitae*, Appendix C to this affidavit.

I swear under penalty of perjury that the foregoing is true and correct, to the best of my knowledge and belief.

Robert E. Hall

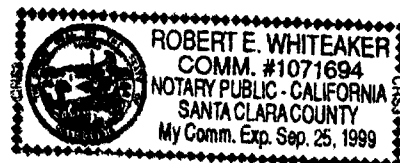
Robert E. Hall

Subscribed and sworn to before me this 8th day of June, 1997.

My commission expires:

~~8/27/97~~ <sup>new</sup> 9/25/99

Robert E. Whiteaker



## *Appendix A. Calculation of Revenue Per Minute*

Revenue per minute was calculated prior to 1993 using public data and after 1991 using revenue per minute numbers obtained from AT&T, MCI and Sprint. Data for 1992 were used to develop a consistent series.

### *A. Calculations Prior to 1993*

There are three main steps, headed *Revenue Calculations*, *Minutes Calculations*, and *Calculation of Revenue per Minute*. The data sources and calculations for each step are detailed in a spreadsheet that can be obtained from Applied Economics Partners.<sup>1</sup> This appendix provides an overview of each step. The calculations begin with 1985 data. The calculations rely as much as possible on data available over the entire time period from 1985 to 1992.

#### *1. Revenue Calculation*

MTS revenues for AT&T and MTS revenues for all reporting companies were the sum of long-distance message revenues and unidirectional long-distance revenues as reported to the FCC. MCI and Sprint MTS revenues were calculated based on the ratio of the total toll revenues for each to the total toll revenues for all reporting companies as reported to the FCC. International MTS revenues were obtained from the FCC. Domestic MTS revenues were the MTS revenues less the international IMTS revenues for each company.

#### *2. Minutes Calculation*

Interstate inter-LATA access minutes for AT&T and all reporting companies were obtained from the FCC, along with the number of interstate and the number of intrastate inter-LATA calls. In some years, the numbers of minutes of interstate and number of intrastate inter-LATA minutes were also available. From these

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<sup>1</sup> Applied Economics Partners, 1010 El Camino Real, Suite 320, Menlo Park, California 94025.

data, inter-LATA access minutes were computed as the number of interstate inter-LATA access minutes times the ratio of total inter-LATA calls or minutes to interstate inter-LATA calls or minutes. MCI data were obtained from MCI.

Bypass access minutes were obtained from the FCC Monitoring Report, July 1991 (1987-1990). The bypass numbers were checked for reasonableness using confidential MCI data. However, the estimate of bypass minutes was less reliable than the other numbers. The confidential numbers obtained for 1992 provided a benchmark for improving these numbers.

Data for international minutes were obtained from the FCC. Prior to 1989, only total international minutes were available. Allocation by carrier was done using international revenues. Since 1989, the number of international minutes is available by carrier.

Domestic inter-LATA access minutes were inter-LATA access minutes plus bypass minutes less international minutes. Inter-LATA conversation minutes were calculated as domestic inter-LATA access minutes divided by 2.07, the ratio of access minutes to conversation minutes calculated by AT&T for its domestic interstate service and used by the FCC to convert access minutes to conversation minutes.

### *3. Revenue per minute*

Revenue per minute was calculated as the ratio of domestic MTS revenues and inter-LATA conversation minutes.

### *B. Calculations After 1992*

Confidential data on revenues and conversation minutes were obtained for AT&T, MCI and Sprint. These numbers were used to estimate revenues per minute. The revenue per minute for the three carriers was calculated as the weighted average for the three carriers using minutes as weights.

### *C. Consistent Data*

To insure consistent data, the two series were linked using 1992 data. The data prior to 1992 were recalculated as the data time the ratio of the revenue per minute from the confidential data for 1992 to the revenue per minute from public sources for 1992.

## *Appendix B: The Marginal Cost of Access*

The marginal cost of access was calculated as follows. First, average interstate access charges in constant 1996 dollars were computed. Then, average inter-LATA access charges in constant 1996 dollars were computed.

The first step in calculating the average interstate access charges was to obtain the premium interstate access charges. A copy of the tariffs from the *FCC Trendline Report*, Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, Table 35 is attached. The interstate non-premium charges were computed as 45 percent of the interstate premium charge for the common carrier line element, the local switching element, and the interconnection element. Next, the number of premium and non-premium access minutes was obtained from the FCC. These numbers were used as weights to compute the average interstate access charge.

Then, the average interstate access charges were converted to 1996 dollars using the GDP price deflator, chained dollar estimates. This was obtained from Department of Commerce, Bureau of Economic Analysis. In order to calculate the inter-LATA access charges from the interstate access charges, the ratio of the intrastate access charge to the interstate inter-LATA access charge was obtained from MCI. The ratio of interstate access minutes to total inter-LATA minutes was obtained from FCC data. The inter-LATA access charge in 1996 dollars was then computed as the interstate inter-LATA access charge in 1996 dollars times the ratio of interstate access minutes to total inter-LATA access minutes plus the interstate access charge in 1996 dollars times the ratio of the intrastate access charge to the interstate access charge times the ratio of intrastate inter-LATA access minutes to total inter-LATA access minutes.

These calculations are summarized in Table B-1.



Table 35  
Interstate Charges by Local Telephone Companies to Long Distance Carriers  
(National Average for "Premium" Service in Cents per Minute) \*

Rates in Effect		Interstate Charges for Switched Access Service				
From	To	Carrier Common Line Per Minute*	Carrier Common Line Per Terminating Minute*	Traffic Sensitive Per Switched Minute	Non-Traffic Sensitive Per Switched Minute	Total Charge Per Conversation Minute
05/26/84	01/14/85	5.24 ¢	5.24 ¢	3.10 ¢	**	17.26 ¢
01/15/85	05/31/85	5.43	5.43	3.10	**	17.66
06/01/85	09/30/85	4.71	4.71	3.10	**	16.17
10/01/85	05/31/86	4.33	4.33	3.10	**	15.38
06/01/86	12/31/86	3.04	4.33	3.10	**	14.00
01/01/87	06/30/87	1.55	4.33	3.10	**	12.41
07/01/87	12/31/87	0.69	4.33	3.10	**	11.49
01/01/88	11/30/88	0.00	4.14	3.10	**	10.56
12/01/88	02/14/89	0.00	3.39	3.00	**	9.60
02/15/89	03/31/89	0.00	3.25	3.00	**	9.46
04/01/89	12/31/89	1.00	1.83	3.00	**	9.11
01/01/90	06/30/90	1.00	1.53	2.50	**	7.78
07/01/90	12/31/90	1.00	1.23	2.50	**	7.48
01/01/91	06/30/91	1.00	1.14	2.40	**	7.18
07/01/91	06/30/92	0.88	1.06	2.40	**	6.97
07/01/92	06/30/93	0.79	0.95	2.40	**	6.76
07/01/93	06/30/94	0.88	1.16	2.20	**	6.66
07/01/94	06/30/95	0.84	1.08	2.10	0.28 ¢	6.89
07/01/95	06/30/96	0.74	0.89	1.96	0.21	6.16
07/01/96	06/30/97	0.72	0.89	1.95	0.17	6.04

\* These rates are the average of price cap and NECA pool companies. Revenues of these companies comprise approximately 95% of the industry total. The rates are weighted averages of the carriers. Carrier common line (CCL) charges are weighted by CCL minutes. The other access charges are weighted by local switching minutes. Rates for the current period are those filed to be effective on July 1, 1996.

\*\* Included with other traffic sensitive charges.

**Table B-1. Access Charges**

<i>Year</i>	<i>Interstate Premium Access Charges (Cents per Conversation Minute)</i>	<i>Interstate Non- Premium Access Charges</i>	<i>Interstate Premium Minutes (Billions of</i>	<i>Interstate Non-Premium Minutes Switched Access Minutes)</i>	<i>Interstate Average Access Charge Per Conversation Minute (Cents)</i>	<i>GDP Deflator</i>	<i>Interstate Average Access Charge Per Conversation Minute (1996 Dollars)</i>
1985	16.63	9.25	142.50	24.70	15.53	78.555	0.1553
1986	14.58	8.33	167.80	15.20	14.06	80.590	0.1406
1987	11.95	7.14	203.90	11.80	11.69	83.064	0.1169
1988	10.52	6.44	235.50	9.20	10.36	86.104	0.1036
1989	9.21	5.91	269.00	8.00	9.12	89.724	0.0912
1990	7.65	4.87	300.40	7.10	7.59	93.639	0.0759
1991	7.10	4.56	322.30	5.80	7.06	97.321	0.0706
1992	6.85	4.45	344.90	4.60	6.82	100.000	0.0682
1993	6.70	4.38	*	0.00	6.70	102.616	0.0670
1994	6.78		*	0.00	6.78	104.958	0.0678
1995	6.53		*	0.00	6.53	107.565	0.0653
1996	6.10		*	0.00	6.10	109.619	0.0610

*Table B-1. continued*

	<i>Ratio of Intrastate To Interstate</i>	<i>Interstate Minutes to Total Inter-LATA Minutes</i>	<i>Average Inter-LATA Access Charge per Conversation  Minute (1996 \$)</i>
1985	1.00	0.76	0.2168
1986	1.13	0.76	0.1974
1987	1.26	0.76	0.1640
1988	1.39	0.76	0.1445
1989	1.52	0.77	0.1250
1990	1.65	0.74	0.1038
1991	1.60	0.75	0.0911
1992	**	0.76	0.0851
1993	**	0.75	0.0809
1994	**	0.75	0.0794
1995	**	0.74	0.0742
1996	**	0.73	0.0677

Source: Access charge tariffs from *FCC Trendline Report, op. cit.*;  
premium, non-premium minutes from FCC SOCC, Table 8.09.  
GDP deflator from U.S. Department of Commerce, Bureau of Economic  
Analysis; average access charges from MCI internal documents.  
\* all minutes are premium; \*\* denotes confidential data.

*Appendix C: Curriculum Vitae Robert E. Hall*

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PhD in economics, MIT, 1967  
BA in economics, University of California, Berkeley, 1964

Senior Fellow, Hoover Institution, and Professor, Department of Economics, Stanford University, since 1978

Previously Professor of Economics, MIT (1974-78), Associate Professor of Economics, MIT (1970-74), Acting Associate Professor of Economics, University of California, Berkeley (1969-70), Assistant Professor (1967-69)

Fellow, American Academy of Arts and Sciences  
Fellow, Econometric Society

Director, Research Program on Economic Fluctuations, National Bureau of Economic Research, since 1977

Member, Advisory Committee, Congressional Budget Office, since 1993  
Member, Oversight Panel for Economics, National Science Foundation, 1989, and  
Advisory Panel for Economics, 1970-72

Member, Yale University Council Committee on Social Sciences—Policy, 1989-94

Member or Senior Advisor, Brookings Panel on Economic Activity, since 1970

Member, President's Advisory Committee on Productivity, 1981-82

**Books**

*Economics* (with Marc Lieberman) South-Western, 1997 (forthcoming)

*Booms and Recessions in a Noisy Economy*, Arthur Okun Memorial Lectures, Yale University Press, New Haven, Connecticut, 1991.

*The Rational Consumer: Theory and Evidence*, MIT Press, Cambridge, Massachusetts, 1990.

*Macroeconomics* (with John Taylor), W.W. Norton, 1986. Second edition, 1988. Third edition, 1991. Fourth edition, 1993. Fifth edition, 1997

*The Flat Tax* (with Alvin Rabushka), Hoover Press, 1985. Second edition, 1995.

*Low Tax, Simple Tax, Flat Tax* (with Alvin Rabushka), McGraw-Hill, 1983.  
*Inflation: Causes and Effects*, University of Chicago Press for the National Bureau of Economic Research, 1982 (editor).

### **Selected Articles**

- “Irving Fisher’s Self-Stabilizing Money.” *American Economic Review Papers and Proceedings*, May 1997
- “Levels of Economic Activity Across Countries” (with Charles I. Jones). *American Economic Review Papers and Proceedings*, May 1997
- “The Productivity of Nations” National Bureau of Economic Research Working Paper 5812, November 1996 (with Charles I. Jones)
- “Macroeconomic Fluctuations and the Allocation of Time,” *Journal of Labor Economics*, 1997.
- “The Effects of Tax Reform on Prices and Asset Values,” in *Tax Policy and the Economy*, National Bureau of Economic Research, James Poterba (ed.), vol. 10, MIT Press, 1996, pp. 71-88.
- “Robert Lucas, Recipient of the 1995 Nobel Memorial Prize in Economics,” *Scandinavian Journal of Economics*, vol. 98, number 1, pp. 33-48, 1996.
- “Productivity and the Density of Economic Activity” (with Antonio Ciccone), *American Economic Review*, March 1996, pp. 54-70.
- “Lost Jobs” *Brookings Papers on Economic Activity* 1995:1, pp. 221-256
- “Reference Guide on Estimation of Economic Losses in Damages Awards” (with Victoria A. Lazear), *Reference Manual on Scientific Evidence*, Washington: Federal Judicial Center, 1994.
- “Nominal Income Targeting” (with N. Gregory Mankiw) in *Monetary Policy*, National Bureau of Economic Research, Studies in Business Cycles, N. Gregory Mankiw (ed.), vol. 29, University of Chicago Press, 1994, pp. 71-93.
- “Macro Theory and the Recession of 1990-91,” *American Economic Review Papers and Proceedings*, vol. 83, no. 2, May 1993.
- “The Value and Performance of U.S. Corporations”(with Bronwyn H. Hall), *Brookings Papers on Economic Activity*, 1:1993.
- “Labor Demand, Labor Supply, and Employment Volatility,” *NBER Macroeconomics Annual*, 1991, pp. 17-46.
- “Substitution over Time in Consumption and Work” in L. McKenzie and S. Zamagni (eds.), *Value and Capital Fifty Years Later*, MacMillan, 1991, pp. 239-267.

- “Invariance Properties of Solow’s Productivity Residual” in Peter Diamond (ed.), *Growth/ Productivity/Unemployment: Essays to Celebrate Bob Solow’s Birthday*, MIT Press, pp. 71-112, 1990.
- “The Relation between Price and Marginal Cost in U.S. Industry,” *Journal of Political Economy*, October 1988, pp. 921-947.
- “Market Structure and Macroeconomic Fluctuations,” *Brookings Papers on Economic Activity*, 1986:2, pp. 285-322.
- “Intertemporal Substitution in Consumption,” *Journal of Political Economy*, vol. 96, no. 2, April 1988, pp. 339-357.
- “Cyclical Fluctuations in the Labor Market” (with David Lilien) in O. Ashenfelter and R. Layard (eds.), *Handbook of Labor Economics*, Amsterdam, North Holland, 1986, pp. 1001-1035.
- “The Excess Sensitivity of Layoffs and Quits to Demand” (with Edward Lazear), *Journal of Labor Economics*, vol. 2, no. 2, 1984, pp. 233-257.
- “Optimal Fiduciary Monetary Systems,” *Journal of Monetary Economics*, vol. 12, no. 1, July 1983, pp. 33-50.
- “The Importance of Lifetime Jobs in the U.S. Economy,” *American Economic Review*, September 1982, pp. 716-724.
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- “Estimation and Inference in Nonlinear Structural Models” (with E. Berndt, B. Hall, and J. Hausman), *Annals of Economic and Social Measurement*, 3/4, 1974, pp. 653-665.
- “The Process of Inflation in the Labor Market,” *Brookings Papers on Economic Activity*, 2:1974, pp. 343-409.

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- "Consumption Taxes versus Income Taxes: Implications for Economic Growth," in *Proceedings of the 61st Annual Conference on Taxation*, National Tax Association, 1968, pp. 125-145.
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- "Tax Policy and Investment Behavior" (with Dale W. Jorgenson), *American Economic Review*, 57, June 1967, pp. 391-414.